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# USSR Report

MACHINE TOOLS AND METALWORKING EQUIPMENT



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## USSR REPORT

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## INDUSTRY PLANNING AND ECONOMICS

### SUMMARIES OF PRESS AUTOMATION CONFERENCE PRESENTED

Moscow KUZNECHNO-SHTAMPOVOCHNOYE PROIZVODSTVO in Russian No 2, Feb 84 pp 35-37

[Article by A. Yu. Makhlin and G. M. Pokrovskaya: "Scientific-Technical Seminar on 'The Comprehensive Mechanization and Automation of Stamping Operations'"]

[Text] The seminar was conducted by the "Mechanical Working" Section of the MDNTP [Moscow House of Scientific-Technical Propaganda] imeni F. E. Dzerzhinskiy and the MGP [Moscow city board] of the NTO [Scientific-Technical Society] for the Machine Building Industry.

More than 550 representatives of industrial enterprises, scientific research institutes and design bureaus from various sectors of industry and from VTUZ [Higher technical institutions] from Moscow and other cities in the Soviet Union participated in the seminar's work. At the plenary session and two seminars on the automation and mechanization of cold and hot stamping more than 50 reports were heard and 7 short films shown. There were thematic exhibits and excursions to ZIL [Motor Vehicle Plant imeni Likhachev], GPZ-1 [State Bearing Plant No. 1] and to VNIImetmash [All Union Scientific Research and Planning Design Institute for Metallurgical Machinery].

In his introductory comments, Doctor of Technical Sciences and Professor G. A. Navrotsky noted that the seminar would examine urgent problems in the comprehensive mechanization and automation of stamping operations in light of the basic directions for machine building development in the 11th Five-Year Plan and the solution of problems in the State Plan for the Economic and Social Development of the USSR in 1983. Automation becomes really effective when it is implemented on the basis of progressive manufacturing processes and a comprehensive approach to the solution of all problems, beginning with the delivery of initial materials and ending with the transportation of finished products to the warehouse.

The reports, communications and collection of materials from the seminar illuminated the past five years' experience in implementing decisions of the 25th and 26th CPSU Congresses and the November 1982 CPSU Central Committee Plenum on production intensification and improving the effectiveness of produced output through the comprehensive mechanization and automation of stamping operations.



The report by the seminar's scientific leader, A. Yu. Makhlin examined ways of comprehensively mechanizing and automating stamping operations. He formulated problems which must be solved by the combined efforts of workers at enterprises, technological NII and design bureaus and VUZ's, with the widespread enlistment of innovators and inventors to develop and expand the technical base for comprehensive mechanization and automation. The structural schemes and flow-sheets for stamping presented showed the directions, essentials and work volume in the comprehensive solution to tasks in the intensification of stamping operations through mechanization and automation.

The report by I. L. Akaro, hot stamping section leader, indicated the tendencies in the automation of forging operations in machine building. After listing the factors determining the methods and means of forging automation, he also enumerated the directions for automation. The first is a flow line form of production organization, based on the creation and manufacture of a range of automated and automatic lines using different types of machinery. Another direction is the creation of comprehensive lines which perform the functions of two or more flow line production units. A third, promising direction is the creation of automated complexes with closed cycles for the production of forgings, semifabricates and parts. These complexes can include machines for welding, surfacing, cutting, assembling, etc.

The construction of specialized forge plants through sector and intersectorial cooperation is optimal for comprehensive automation.

The state and prospects for the production of automated forge and press equipment (FPE) at Minstankoprom [Ministry of the Machine Tool and Tool Building Industry] plants for the comprehensive mechanization and automation of stamping operations were illuminated in the reports by I. M. Podrabinnik (ENIKMASH) [Experimental Scientific Research Institute for Forge-Press Machine Building] and V. N. Gorozhankin, A. T. Achkasov, and V. B. Urazov, representatives of press building enterprises in Voronezh. It was estimated that the productivity of FPE which is going into operation in the 11th Five-Year Plan will be 1.4 fold higher than that built during the 10th. Eighty percent of the productivity growth is through the production of automated FPE, which will increase to 34-36 percent of total production by 1985. The greatest volume in total output (about 55 percent) will be 50 types of general purpose and specialized machines produced without devices for mechanization and automation and which are sometimes supplied with automated complexer or on order with various mechanization devices.

Doctor of Technical Sciences and Professor G. P. Teterin (VZPI) [All Union Correspondence Polytechnic Institute] reported on experience in the optimization and automation of control processes in stamping operations.

A number of reports illustrated by specific examples shared experiences in the preparation for and implementation of comprehensive mechanization and automation:

A. I. Bogatyrev (ZIL) -- on the creation and successful operation of a comprehensively mechanized section for stamping truck frame rails. There was a demonstration during the trip to ZIL;

P. A. Rogoznikov and N. I. Volodin (NPO NIItaktorsel'khoz mash) [NII for Tractors and Agricultural Machinery] -- on a comprehensively automated line for the production of spring supports for farm machinery, capable of producing 1 million supports annually. The line's introduction will free 22 workers from heavy monotonous labor, save 2,518 tons of rolled metal and have an economic effect of 362,000 rubles;

V. V. Shteyman (VPTIstroydormash) [All Union Design-Technological Institute for Construction and Road Machinery] -- on comprehensively mechanized lines for making large dimension annular billets. One of them consists of an accumulator, shelves with mechanical part delivery, an electro-slag welding unit, a gas burning machine, a device for marking off billets, a transporter-accumulator, a unit for grasping and feeding oriented billets, a pre-heat furnace, a bending machine, a roller conveyor, a unit for the intermediate storage of billets; manipulators, a cantilever type rotating crane, a welded ring tilter, shelves for mandrels and a waste container. At a program level of 18,000 units annually, total cost reductions were more than 300,000 rubles and about 1,000 tons of metal were saved.

V. Ya. Borisov (PO Rostsel'mash) -- on practical experience in preparing and implementing the comprehensive mechanization and automation of work places and sections in the plant's press building. This work was based on: the study and use of designs for automation and mechanization working units; the unification and sequencing of design decisions; the use of group technology and standardized technological and design decisions.

Ye. V. Kozlovskiy examined means of comprehensively mechanizing the manufacture of heavy sheet stamping billets meeting these requirements: universality and readjustability with regard to the entire assortment of parts stamped; accuracy of billet positioning in press, high speed, eliminating the interim cooling of billets.

Solutions to production intensification problems put great importance on cross and skew [klinovaya] rolling. These were the subject of reports by Academician A. I. Tselikov, and representatives from ZIL, Yu. N. Sergeyev and I. Ye. Gutkin. The automatic part rolling mills developed at VNIImetmash and introduced in industry have high productivity: 400-600 40 mm balls, or 80-100 80 mm diameter balls per minute, or 6,000-7,000 20 mm shaft type parts per hour at a tolerance of  $\pm 1$  percent. Metal savings compared to traditional methods of working are 10 to 30 percent and the metal use factor is increased by 0.15-0.20. Experience in the operation of these kinds of machines shows radical improvements in labor conditions, the complete elimination of manual labor and sharp reductions in noise and gas. The introduction of two gear rolling mills at the ZIL forge shop saved 3.5 kilograms of metal per rear axle pinion and released 13 worm gear cutting machine tools.

D. I. Shumeyko (Kommunar Motor Vehicle Plant in Zaporozhye) described automated complexes for the sheet stamping of average size body parts. The automatic operation of general purpose presses with up to 6 dies increased labor productivity 5 fold. The introduction of such complexes for stamping 6 types of parts had a 28,000 ruble annual economic effect.

V. I. Biryukov (AZLK) [Motor Vehicle Plant imeni Leninist Komsomol] used his plant as an example of the possibilities of building automated adjustable lines with manipulators for stamping medium and large sized parts for the Moskvich car. One such line makes four types of parts. The lines are serviced by 3 set-up workers and 2 stamp operators. There is one operation every 7.5 seconds and an actual productivity of 400 pieces per hour. The readjustment of dies and automated equipment takes 1.5 hours.

A. A. Petin gave a report and showed a film on the automatic complexes for the cold extrusion of parts developed by NIITavtoprom [Scientific Research Institute for Motor Vehicle Industry Technology] and introduced at KamAZ. This complex has improved productivity 3-3.5 fold.

O. N. Gerasimenko, A. A. Akopov and others reported on the development of an automatic complex for stamping small parts from bands in series and small series runs. The complex, consisting of an AG5-10 automatic 100 kN press and a UR1-50 reel, has a 10-15 minute readjustment time, low metal intensiveness, improved productivity and press and die wear resistance. To reduce readjustment time the press is equipped with a mechanism for high speed attachment of dies and a quick adjusting special feed shaft. The complex works material 0.3-0.8 mm thick, 10-50 mm wide, feed accuracy is  $\pm 0.15$  mm, number of ram passes per minute: 150, 200, 300.

As our industry makes significant use of stamping from strips to produce parts in series and small series runs with relatively frequent changes in output, the automation of these kinds of stamping operations is one of the most urgent problems.

M. A. Bokman and I. V. Kreynov presented a report and film on the ASHK-40 automated stamping complex. The complex includes a KD series produced press, mechanisms for changing, attaching and releasing packets of dies, a gripper for moving the upper strip from an elevated table and moving it to the upper roller feed, a two sided roller feed into the working zone up to the support and shears, a strip stop, containers for parts and wastes and a strip waste cutter. It also has a block for standardized die packets. The complex is designed for the simultaneous installation of five dies, the same number of strip stops and sets of packages for parts and wastes. It can thus sequentially stamp five types of parts automatically without any direct human participation. Readjustment from stamping one part to another is automatic. The set-up person observes the operations, reacts to signals from the interlock and supplies packets of dies and other parts. This is done without stopping the complex. Such complexes can be used to set up flexible automated production operations.

S. I. Lyapunov reported on the use and prospects for robots in stamping operations in tool and instrument building. The approved program calls for the introduction of 7,000 industrial robots and manipulators in stamping operations. This program's implementation calls for the development and organization of series production of robot and manipulator modules from which the units and industrial robot complexes can be built to suit specific conditions.



Yu. T. Agafonov and M. S. Kogan shared their experience in the development and applications prospects of industrial robots for the comprehensive mechanization of hot stamping on HSCP [Hot stamping crank presses]. The report presented the layouts for HSCP lines equipped with robots for loading and interoperational transfers.

A. P. Shishulina, A. V. Talalova and others reported on robotized complexes based on HSCP-63MN's using Universal-15.01 and Universal 15.03 industrial robots. The robots load billets into induction heaters, transfer semi-fabricated forms to die impressions, transport forgings from the stamping press to the cutter, remove and pack them. It is intended to mechanize die changes and the supply of lubricant to the dies. The complex's hourly productivity is 120 billets 90x120 mm in cross section, 150 to 300 mm long and weighing up to 30 kilograms.

Yu. A. Bocharov (Moscow Technical School imeni N. Ye. Bauman) and N. V. Kovalev, in analyzing the efficiency of automating forge-stamping equipment, concluded that it is advisable to use complexes with manipulators and robots for series production and clamp transfer units for mass and large series production.

D. A. Shushko reported on the basic characteristics and economic efficiency of the introduction of robotized manufacturing complexes in cold stamping operations.

In covering the potential assortments of equipment in comprehensive mechanization and automation, the seminar focused on individual mechanisms and devices. Thus, I. L. Akaro, in drawing inferences from experience in the use of restackers when stamping with HSCP's, formulated the basic demands made upon these devices depending upon the type and shape of the forgings. He also showed possible layouts for moving semifabricated forms and forgings and kinematic schemes for restackers with automatic drives and drives from press rams. The use of restackers improves stamping productivity 1.2-4 fold. In his opinion the use of HSCP with restackers together with other automation devices is the basis for comprehensive mechanization and radical changes in the conditions and content of labor in forging operations.

N. A. Usenko and L. F. Anchishkina reported on vibratory-rotational feeders, which are expanding and supplementing the possibilities for vibratory feeders. Their productivity is considerably higher than that of the latter because of the mass nature of their grasp, the control over movement trajectory and kinematic parameters of parts in each flow.

A. N. Davydov reported on a periodic rotation mechanism for a feeder and an automatic feed with positions up to 180° without breaking the kinematic chain. O. N. Gerasimenko and A. Kh. Tlibekov reported on new designs for shaft mechanisms to feed easily deformed materials, which were developed and introduced at a number of instrument building plants.

G. D. Skvortsov and A. A. Vilitkovich reported on devices for mechanizing die change and attachment developed at NIITavtoprom and introduced at motor vehicle plants.

V. L. Losina explained standardized solutions to the comprehensive mechanization and automation of sheet presswork.

The following reported about newly developed and introduced press-automats:

Professor V. P. Romanovskiy and inventor V. A. Lyashchenko on new types of highly productive automats for sheet presswork. There was a demonstration of a 100 kN model;

V. I. Zhigaro on a new sheet press automat with accurate automatic shaft feed of bands;

V. Ye. Svistunov (Plant VTUZ imeni A. I. Likhachev) on a high speed cutter with upper drive (Model AA-6350);

L. N. Dubrovin, V. G. Levitskiy and V. N. Sopochkin on a press-automat for the hydromechanical stamping of nipples developed and introduced by the NPO NIITraktorsel'khoz mash. This device combines a progressive manufacturing process with high productivity. Producing 30 million nipples annually, the economic effect was 3,700,000 rubles, 2,300,000 rubles were saved and 237 people conditionally released.

The following reports illuminated questions of technology in stamped fittings:

L. Ya. Mokshanova (VZTMP) on demands made upon technology and instruments in the comprehensive automation of forging operations;

S. S. Solovtsev and A. A. Koz'min (Stankin) [Moscow Machine Tool and Instrument Institute] on stamp-automat for cutting accurate billets with lengths considerably shorter than diameters;

V. A. Dyundina (GPZ-1) on experience in designing technology and dies for the automated production of wheel bearings;

G. D. Skvortsova, M. D. Shamisa and others (NIIavtoprom) on structure and strength of dies for cold extrusion working in automated complexes.

The following recommendations were made on the basis of examining and drawing conclusions from the reports, communications and speeches:

1. Based on the experience of progressive domestic enterprises, comprehensive mechanization and automation are considered one of the decisive conditions for accelerating solutions to tasks in the intensification of stamping operations.

2. The successful and universal comprehensive mechanization and automation of existing production operations requires the efforts of specialists in the technological services of enterprises, with the help and direct participation of sector technological NII's and KB to develop, on the basis of a detailed analysis of existing stamping operations at each enterprises, of long term plans (designs) for comprehensive mechanization and automation, delineating the first priority solutions to urgent tasks.

The plans (designs) should foresee the mechanization or automation of the basic and auxiliary manufacturing processes for all types of work performed in a shop and include time frames for reaching levels of comprehensive mechanization or automation at each work place, line, section and shop as a whole.

Conduct reliable technological, organizational and psychological preparations for the active and universal introduction of industrial robots, manipulators and robot-technological complexes.

3. In the development of long term plans (designs) and in making new decisions on mechanization and automation, widely use available experience at enterprises and organizations:

In the area of cold stamping:

Organizing the preparation and implementation of comprehensive mechanization and automation: PO Rostsel'mash, PO AvtoVAS;

Standardized solutions to comprehensive mechanization and automation: PO Rostsel'mash;

Unification and standardization of manufacturing processes and dies: VAZ, KamAZ, NIITM (Rostov na Donu);

The use of industrial robots, manipulators and robot technological complexes: AvtoVAZ, PKTI Kuzrobot;

Automated complexes: Kommunar Motor Vehicle Plant in Zaporozhye, AZLK, ZIL, NIITavtoprom;

Mechanization and automation equipment used in existing production: ZIL, VAZ, PO Rostsel'mash, NIITavtoprom, NIITraktorsel'khoz mash, Zaporozh'ye Motor Vehicle Plant;

In hot die forging:

Complexes of mechanization and automation equipment used in the hydraulic press stamping parts from thick sheets up to 10 tons, for wheels up to 3 m diameter, bending on special machines and welding (VPTIstroydormash);

Making parts from 20 to 600 mm diameter pipe by rolling and roll seaming (Kramatorsk Industrial Institute);

The use of specialized part rolling mills for producing large drive screws, shafts, axles, gears, balls, wheels and other axially symmetric parts: VNIIMETMASH;

The use of billet restackers within the working space of 0.63 to 40 MN hot stamping crank presses;

Automatic one and two stand forge rolling mills: Plant KPO imeni M. I. Kalinin;

The use of Universal-15 industrial robots in forge operations: Izhevsk Mechanical Institute;

Comprehensively automated lines for forge operations: KamAZ, VAZ, PO Rostsel'mash, TSBKM, ENIKmash, NPO NIItaktorosel'khoz mash.

4. The foundation for successful plans (designs) for comprehensive mechanization and automation should be the creation of a technical base through the organization of intersectorial (in the Minstankoprom system) and sectorial production associations, plants, shops and sections for the manufacture of individual components and mechanisms (modules) for machines, complexes, control systems and equipment, transport equipment, and special fittings to be delivered pending orders from customer enterprises.

5. Improve the standards and quality of plan and action agreements and coordination among Minstankoprom organizations in the development of press-automats, automated and automatic complexes and devices for mechanization and automation with plans and actions of sectorial technological organizations, institutes of the Academy of Sciences and academic institutes, placing special attention on expanded NIR [Scientific research work] and OKR [Experimental design work] on progressive methods and means of mechanization and automation, including flexible automated operations, industrial robots, manipulators and robot technological complexes.

6. It is considered urgent to work out intersectorial guideline materials on the following:

Determination of criteria and application areas for automatic and automated complexes and lines produced by Minstankoprom;

Technical and economic indicators specifying and defining the comprehensive mechanization and automation of work places, lines, sections and stamping shops in general having standardized structures for production and labor organization.

The development of materials to widely inform workers in the metal working branches of industry.

7. It is considered necessary to develop criteria for evaluating the effectiveness of improvements in the general standards of production, safety, reductions in fatigue and other social factors having substantial influence upon improving efficiency. These should be included in the methodology for calculating the economic efficiency from the introduction of mechanization and automation.

8. In conducting NIR and OKR at Minstankoprom and sectorial technological organization scientific research institutes and design bureaus the following should be done first:

The improvement of existing and the development of new, more productive automatic and automated complexes for the entire assortment of stamped parts;

The creation of flexible automated production operations and new, highly productive manufacturing equipment (including industrial robots and manipulators for the comprehensive mechanization and automation of intersectorial, sectorial and intraplant operations);

The determination of requirements made upon stamped parts, manufacturing processes equipment and fittings in performing work at automated production operations.

9. Increase the production of bands necessary for stamping.

Mechanical working sections should give these recommendations to organizations institutions and departments, which can assist in the solution to tasks in the comprehensive mechanization and automation of stamping operations.

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## INDUSTRY PLANNING AND ECONOMICS

### DEVELOPMENT OF SOCIALIST BEARING PRODUCTION CAPACITY

Moscow EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV in Russian No 5, May 84  
pp 51-54

[Article by Aleksandr Kopets', chief of the OSPP Secretariat: "The OSPP: 20 Years of Dynamic Development"]

[Text] It has been 20 years since the day in Warsaw when the chairmen of the councils of ministers of the People's Republic of Bulgaria, the Hungarian People's Republic, the GDR, the Polish People's Republic, and the CSSR signed the agreement establishing the Organization of Bearing Industry Cooperation (OSPP), which the Soviet Union, the Socialist Republic of Romania, and the SFRY then joined. Now the Republic of Cuba and the SRV also take part in the work of the OSPP.

The work on joint development of the bearing industry in section 11 of the CEMA [Council of Mutual Economic Aid] permanent commission on cooperation in the machine building field served as the basis for the formation of the OSPP, one of the first international economic organizations of an industrial nature for member-countries of the SEV. By the same means a base was established for coordinating bearing industry development in participating countries, and much work was done on specialization of production, limitation of reciprocal shipments of bearings, standardization, and organization of exchange of records, experience, and scientific and technical achievements.

More than 10,000 basic standard sizes of roller bearings are produced in the world, and about 40,000 modifications of them. Not one enterprise is in a position to manufacture all the variety of existing standard sizes. The profitable production of such a massive precision output requires maximum automation. It is not coincidental that the bearing industry was the first among the machine-building branches of socialist countries to adopt organized forms of expanding cooperation aimed at the maximum satisfaction of the demand of national economies by its goods.

The tasks and rights defined in the agreement not only allow the OSPP to conduct far-reaching activities in coordinating specialization of production, scientific-research projects, and the development of production, but provide the opportunity to use reserves, obtained by joint capital investments and the development of suitable proposals for the higher organs in OSPP participating countries, for their coordination.

A rational international division of labor and maximal satisfaction of the demand for roller bearings in OSPP participating countries were and are considered the fundamental tasks of the OSPP, as well as enacting measures to raise the quality of bearings produced and to disseminate favorable experience in the area of technology and production organization, with a view to increasing the efficiency of labor in all the countries.

The highest organ of the OSPP is the Directorate, which consists of permanent representatives from the participating countries. The OSPP Secretariat is the permanent working organ. Its function is the operative fulfillment of Directorate decisions.

#### Economic Cooperation

Roller bearing output from the beginning of the activity of section 11 through the integration of production has been of a dynamic character: from 252 million pieces in 1955 to 671 million pieces in 1964. It must be noted here that they were not produced at all in the People's Republic of Bulgaria or the Hungarian People's Republic in 1955.

Since the OSPP came into existence, thanks to coordinating measures and the mutual aid of participating countries, the production of roller bearings is growing quickly (see table).

Production of Bearings (Units) in OSPP Participating Countries (1965-1982)  
(in millions of pieces)

Country	1965	1970	1975	1980	1982
People's Republic of Bulgaria	6.5	9.0	11.5	19.3	28.6
Hungarian People's Republic	12.6	16.5	19.6	23.5	27.5
GDR	39.2	54.1	77.9	90.0*	91.0*
Polish People's Republic	34.1	51.4	95.2	125.0	105.0
Socialist Republic of Romania	13.6	24.5	70.6	102.0	109.0
USSR	524.5	673.0	907.0	1050.0	1081.0
CSSR	40.6	50.9	69.6	68.2	71.7
SFRY	3.2	4.2	9.1	19.2	26.2
* Projected data					

In 1982 the total production of roller bearings, including joint bearings and ringless bearings, in participating countries was 1.8 billion pieces. This means that production volume for the entire period of cooperation increased by a factor of 7.2, and in comparison with 1964 by a factor of 2.7; as a per capita figure it has reached the level of the world's developed capitalist countries. At the present time 30 percent of the entire world output of bearings is manufactured in OSPP participating countries. The range of products being produced includes about 10,000 standard sizes.

Such fast rates of development have been made possible by constant modernization and renovation of the branch's machine stock. At the present time quantity and large-lot production have been set up in shops that have a high degree of automation and are equipped with highly accurate automated lines and precision machines. It should especially be noted that the bearing industry in socialist countries is now developing completely independently. It manufactures bearings of virtually any degree of complexity and in the necessary quantity.

A bearing production shop equipped with machines with programmed numerical control



Simultaneous with the growth of production volume, the range of products has significantly increased in every OSPP participating country in accordance with specialization, and production of bearings with higher accuracy ratings and various modifications has been organized.

One of OSPP's most important tasks, facilitating more complete satisfaction of countries' demands for roller bearings, is reciprocal shipments of them based on specialization of the standard sizes that are coordinated (from 14.4 million pieces in 1964 to 80.5 million pieces in 1982, i.e., by a factor of 5.6).

Shipments are carried out on the basis of a contract, signed by all the participating countries, for multilateral specialization and cooperation of roller-bearing production in OSPP participating countries for the period 1976-1980; it has been extended by special protocol for 1981-1985. (Preliminary work is going on now for extending the contract for 1986-1990). The volumes of reciprocal roller-bearing shipments defined in the contract have been included in the CEMA member-countries' agreed plans for multilateral integration measures for 1976-1980 and for 1981-1985, and are obligatory for all CEMA member-countries. On the basis of the contract yearly plans are being worked out for the production and reciprocal shipments of roller bearings, with a view to specifying the tasks of five-year plans for cooperation. The methodology of such development stipulates the use of computers.

At the OSPP the results of fulfilling contracts on reciprocal shipments are constantly being examined.

In spite of the great successes achieved by OSPP participating countries in production and in specializing and increasing reciprocal shipments, they have so far not been able to eliminate completely the shortage of certain types of bearings, particularly large-sized ones. Complete satisfaction of the roller-bearing demand of OSPP participating countries requires that new production capabilities be established in the near future, and that cooperation be further expanded. It is in this direction that the OSPP is conducting its primary projects at the present time and will continue them in the next five-year plan.

#### Scientific and Technical Cooperation

Scientific and technical cooperation, for the coordination of which the Directorate's Scientific and Technical Council was established in 1974, has been well developed in recent years. Under the council's direction, all questions of the technical development of the bearing industry are decided, and plans for projects and consultations are put together, as are methodological materials.

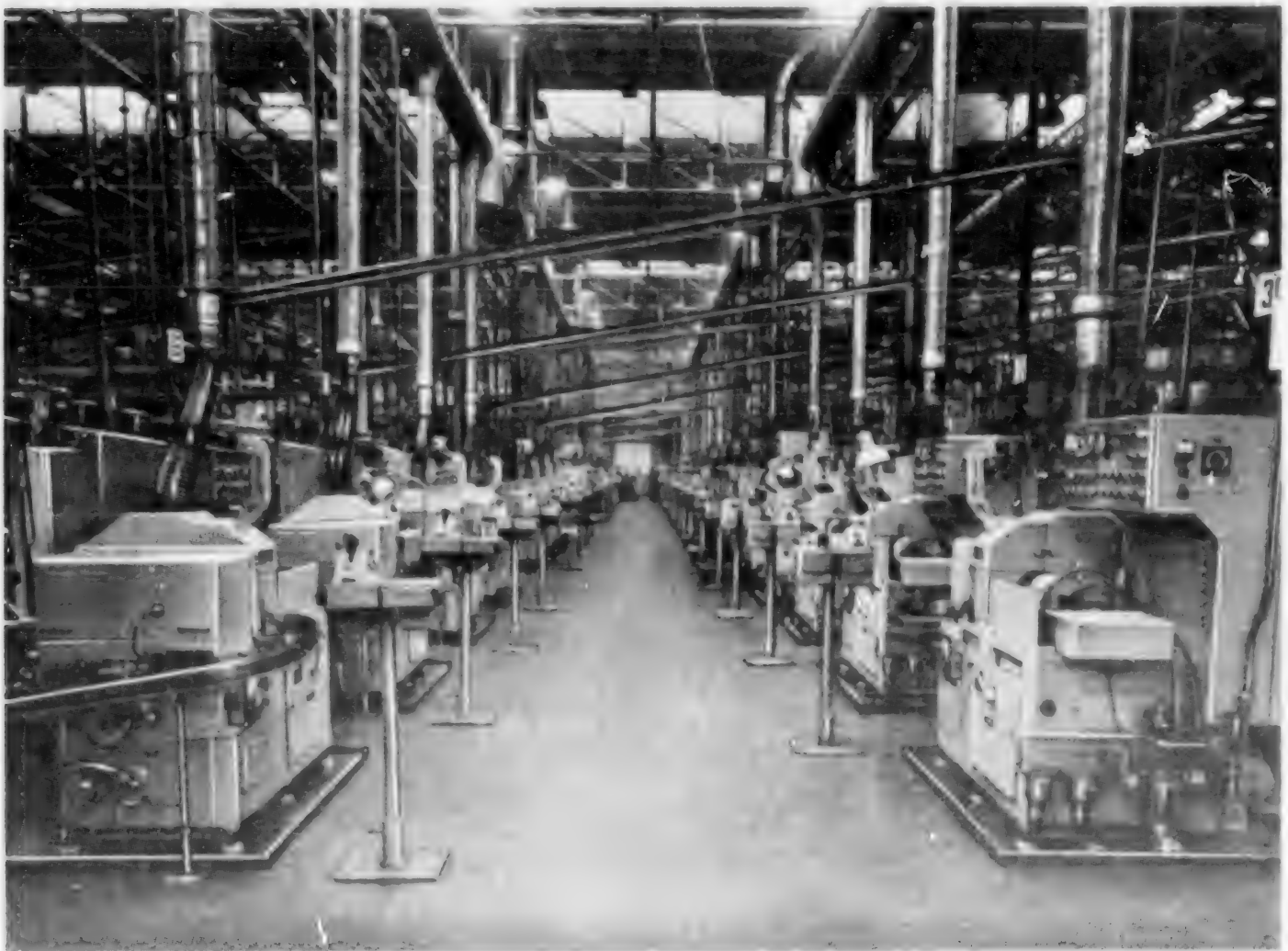
The subjects of the joint scientific studies and design projects conducted on the basis of five-year plans are directed toward: the development of new bearing designs and the modernization of existing ones; the preparation of new processes for the manufacture of roller bearings and their parts, and the perfection of existing ones; the development of advanced methods of quality control for roller bearings and their parts as well as for materials; procuring new materials for the manufacture of bearing parts and materials for their processing; expanding the coordination and specialization of design projects in the development of special equipment.



On the basis of scientific and technical cooperation among countries, the following have been developed: new production equipment, test rigs, special fixtures, tools, and new techniques for bearing production that are being used successfully and that provide significant economic effect. Taking into account the up-to-date experience of OSPP participating countries, standard manufacturing processes have also been developed for more massive design and technological groups of bearings. Comparative tests are being conducted on the longevity of bearings and on an analysis of their quality; measures that improve bearing quality are being prepared according to the results of these tests. The labor input to the production of the most widespread standard sizes of bearings is analyzed annually.

There is special significance in the establishment of a working group of specialists of the participating countries on the problem of "developing methods for cold rolling races" and instituting these methods in OSPP participating countries. Important work is being conducted on the use of powder metallurgy methods.

A modern bearing production shop





Much attention is being devoted to further increasing production automation and to replacing manual labor, particularly in shops with difficult and hazardous conditions. The production and use of robots being developed now in sister countries serves this end. The favorable experience of one country finds acceptance and further development in other OSPP participating countries.

In accordance with five-year plans for roller-bearing standardization, 37 **CEN** standards have now been drawn up for roller bearings and their parts, as well as a large number of guiding technical materials and recommendations for standardization.

Within the framework of the OSPP an automated control system (ASU) is also being instituted in the bearing branch. For example, the ASU has found practical application in preparing and conducting the annual conference on the coordination of production plans and reciprocal shipments of roller bearings.

The OSPP Directorate attaches great significance to the exchange of scientific-technical and economic information among participating countries, as well as information on patents and inventions, the results of testing prototype equipment, instruments, and tools, and on bearings purchased in other countries. The OSPP Secretariat puts out two bulletins semi-annually: "Technical and Economic Information" and "The Bulletin on ASU Problems" for the operative transmission of information on the scientific and technical achievements of individual participating countries in the development of bearing production.

The bearing plants of OSPP participating countries cooperate directly in the production of special non-standard equipment and fixtures manufactured for their own needs.

Their cooperation is carried out on the basis of the protocol on the character and forms of cooperation between the Organization of Bearing Industry Cooperation and the Council of Mutual Economic Aid. OSPP activity always corresponds to the coordination of development plans and to the specialization and cooperation of production and reciprocal shipments of bearings, equipment, and materials for the bearing industry, as well as to the coordination of scientific-research and design projects, and the unification and standardization of roller bearings. This is connected first of all with the development and realization of corresponding measures stipulated by the complex program and by long-term special cooperation programs, as well as by other important measures in the sphere of material production.

The OSPP cooperates directly with the SEV permanent commissions on cooperation in the areas of machine building and ferrous metallurgy, and with the SEV Institute of Standardization and the MIEP MSS [International Institute of the Economic Problems of the World Socialist System] in the area of standardization.

#### The Social Aspects of Cooperation

OSPP participating countries devote particular attention to the training and education of young workers and engineering and technical cadres for the bearing industry, as well as to the establishment and development of a complex system of social and cultural-recreational facilities for the branch's workers.

One of the new forms of cooperation among OSPP participating countries is the annual contests and competitions among the young students of professional-technical training schools for the rank of best in the profession: turner, milling machine operator, metal worker, etc. Such a form is a graphic example of connections and methods of disseminating experience and exchanging it in professional and technical training in the individual OSPP participating countries.

In the bearing industry of these countries great importance is attached to the creation and development of cultural and social conditions for workers to rest and improve their health. Bearing plants and integrated works have available a complex of holiday homes, medical institutions, cultural facilities, libraries, sports facilities, kindergartens and nurseries, and plant cafeterias. An exchange of vacation accommodations for workers and their families is being organized within a framework of bilateral cooperation.

In the OSPP's 20 years of activity significant successes have been achieved in the development of cooperation in maximally satisfying the roller-bearing demands of its participating countries, in the quality of production, and in disseminating favorable experience in the improvement of production technology and organization.

The immediate goal of the OSPP is to expand cooperation among participating countries. The solution of the following problems requires particular attention: developing production of standard sizes of roller bearings that are in short supply, including large-sized ones; improving the capabilities of scientific-research and design organizations in OSPP participating countries, and of special plants for the production of prototypes and small lots of special equipment, machines, and fixtures for roller bearings; expanding the cooperation of interested OSPP participating countries in import-export in the markets of other countries; working out feasibility studies for joint capital investments in the bearing industry.

The realization of these tasks will serve the further expansion of integration and the still more dynamic development of the bearing industry in OSPP participating countries on the basis of equality, mutual profit, and mutual aid for the purpose of fulfilling long-term special programs for the cooperation of SEV member-countries, which will be the concrete definition and development of a complex program of socialist economic integration.

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## INDUSTRY PLANNING AND ECONOMICS

### LONG TERM VIEW OF FMS IN SOVIET INDUSTRY

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 31 Jul 84 p 1

[Article: "The Potential of Automation"]

[Text] At a meeting with workers of the Moscow Hammer and Sickle Metallurgical Works, comrade K.U. Chernenko stated that: "At the present time, special importance has been attached to the technological re-equipment of metallurgical plants and the introduction of the newest achievements of science and advanced research. We can say that this is the real requirement of our times and the command of the epoch in which we live."

The work done by metallurgical workers in Moscow clearly shows the chief means for solving this task. The reconstruction work done at metallurgical works has resulted in modern equipment complexes that make it possible to increase labor productivity by 22 percent. About 1200 workers have thus been freed from labor-intensive operations. They are now employed in integrated-mechanized and automated production cells.

Automation has not become one of the chief means of intensifying production, increasing labor productivity and improving work conditions and technology. Many complex, high-speed, precision processes in electronics, chemistry and nuclear power engineering that could not be controlled by humans are successfully managed by automation. Robots and manipulators have begun to be used for painting, rust-proofing and welding in galvanizing shops and this saves personnel from work in unhealthy conditions.

Automation also has a special role: because of its high degree of precision, automation saves a considerable amount of material resources. For example, in the power engineering, metallurgy, chemistry, cement production and other power-intensive industries, there are already about 1000 technological process automated control systems in use. Each year, they help create a savings of about 9.5 billion kilowatt-hours of electric power, 24.8 million gigacalories of heat and 6.1 million tons of reference fuel.

Today, however, the work on automated processes and systems has achieved a qualitatively new stage of progress. The CPSU Central Committee Politburo has approved measures proposed by the USSR Council of Ministers to accelerate the automation of the machine-building industry by introducing

advanced technological processes and flexible readjustable complexes. This means that, for many factories and entire shops of the metallurgical industry, the conversion to flexible manufacturing systems will become the backbone of technological progress and the efforts of thousands of specialists will be needed.

The conversion to automated processes of course attaches a special role to machine builders. In small-lot production which is responsible for 70-80 percent of machine building in the Soviet Union, it is no secret that the coefficient of use of NC tools at this time has reached an average figure of 0.4-0.6. The work shift factor for this equipment's use does not exceed 1.3-1.6. In other words, its usable efficiency is still much below its possible levels.

Flexible production complexes radically change the situation. Thanks to automatic systems for loading machines and changing tools, machine tools can work round the clock in "personnel-free" mode. A computer and flexible transport system make it possible to increase the equipment load to a factor of 0.85-9. The working cycle is altogether reduced 2-3 times and an output of the very same volume of production requires much less machinery while labor productivity is increased several times of production costs are lowered.

At the present time, about 20 FMS [flexible manufacturing systems] lines and complexes are in operation in the Soviet machine building industry. In the coming years, many more of these systems will be coming into use. In particular, by the end of this decade, the introduction of flexible production complexes and automated design systems should produce a savings of about 5 billion rubles.

It is understood that this gain in output and savings will not simply come of itself. Flexible production complexes with their diverse systems and devices and their complex interaction are complicated and expensive. For them to produce a hundredfold return on the investment, their widespread introduction should be preceded by extensive research and large-scale creative, organizational work at all levels of technological process control.

In creating a flexible production system, the consideration given the type of given production and the prospects for its development determines to a great extent the effectiveness of the complex. Much in this regard depends on the plant's engineers and technicians.

It would, however, be an error to place all the responsibility on the plant personnel alone. The creation of flexible production complexes involves the solution of complicated programs involving electronics, precision mechanics, control programming and theory, reliability and mathematical software. Here, enterprises will not be able to manage without the help of the branch sciences. Producers therefore do not need broad recommendations but specific designs and plans. The attention of both the metallurgical industry's leading cadres and the party organizations should be riveted to the deepening of the interaction of science and production.

The new step in the automation of metallurgical production was made with a great amount of creative work. It has been only during the present five-year period that we have seen in our country the production of over 20,000 robots and manipulators, a five-fold increase in the production of microprocessors and a two-fold increase in the output of microcomputers. The specific weight of NC equipment in overall machine-tools production has become about one third.

However, the designers of equipment, systems and devices necessary to the creation of versatile production complexes now face new tasks. They must considerably improve the performance characteristics of the technology and above all its reliability. This great responsibility also lies on the USSR State Committee on Science and Technology, the State Planning Commission and scientists of the USSR Academy of Sciences. They must consistently encourage practice of the principle of a single technological policy and the fundamentals of specialization and industrial cooperation.

Production automation has now become one of the areas of Soviet life in which the achievements of the scientific and technological revolution will help us to unite our practical actions with the advantages of the socialist system of management. There is no doubt that scientists, specialists and innovators will not put all of their efforts into honorably fulfilling this most important task.

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## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

### TWO 'WORLD CLASS' MACHINE TOOLS PRESENTED

#### Semiautomatic Internal Grinding Machine

Moscow EKONOMICHESKAYA GAZETA in Russian No 32, Aug 84 p 16

[Text] In 1984, Soviet industry mastered the mass production of a series of new world class high-output and precision machine tools. Let us become acquainted with these two new devices.

Semiautomatic ME386A6 internal grinding machines which were first produced at the Moscow Automated Line Works are designed to make second accuracy class bearing races of diameters above between 150 and 500 mm. The race designs incorporate basic trends of modern technology such as modular construction and unification of design. The coefficient of applicability of standard-size parts is as high as 90 percent.

The characteristics of the Soviet grinding machine place it on par with the best models of firms such as Famir (Italy), Bryant (USA) and (Vumard) (Switzerland) but the precision characteristics of the Soviet model such as its size tolerances, conicity, the magnitude of roughness or buckling of the worked surface are 1.2 to 2 times better than those of the above-named foreign models.

The digital program control system with a step-by-step motor in the power circuit makes it possible to operatively reset the semiautomatic grinder from one mode to another. Therefore, such grinders can then be used for small-lot production as well. Within an hour, the semiautomatic can produce up to 15,240 mm rings with a tolerance of 0.05 mm.

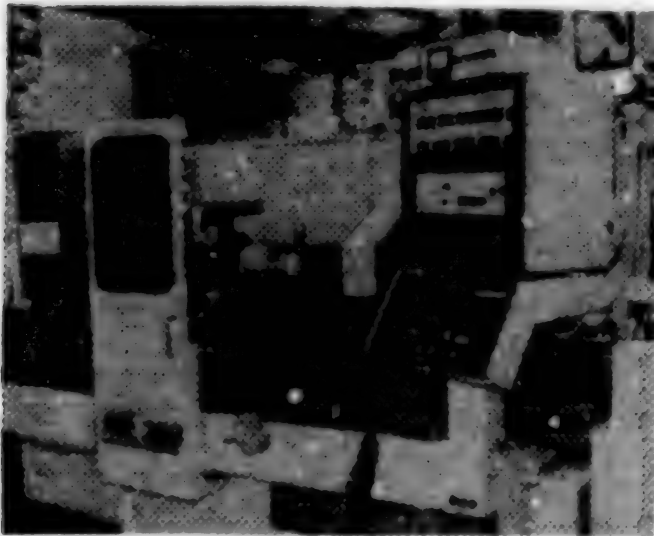
The annual savings made possible by the introduction of one M386A6 is more than 50,000 rubles. The manufacturers are currently considering a design to roboticize the unit.

### New K-2128F3 Automated Press

Moscow EKONOMICHESKAYA GAZETA in Russian No 32, Aug 84 p 16

[Article by A. Mishin: "Automated Press"]

[Text] K-2128F3 presses have been designed and are manufactured by the Azov Forge and Press Equipment and Automated Line Special Design Bureau. These presses perform cold stamp machine parts from sheet metal or other such material. Stamping, piercing and cutting metal scraps to measured lengths are only a few of the press's possibilities. The press is equipped with a digital program control system and can be operated in automatic mode for one or more shifts. It is only necessary to load the magazine with the proper dies and blanks and to assign a digital control program. One of the main advantages of the press is that it can be used in small-lot production. The press can quickly change die cartridges automatically and as well as the piles of strips stored in 16 moveable magazines. A press-module of this type is easily built into flexible production systems. This is the first design of its type to be used anywhere in the world. In the opinion of Soviet and foreign specialists, the press is a qualitatively new step in the technological development of sheet-metal stamping and is a basis for creation of future automated presses.



Semiautomatic internal grinding machine



K-2128F3 automated press

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## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

### LENINGRAD PLANT RECEIVES 50 NC MACHINE TOOLS

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Aug 84 p 2

[TASS article: "Outfitting Completed"]

[Text] The Leningrad V.I. Lenin Optical Machinery Combine's machine shop has been reequipped. One-hundred general-purpose machines have now been replaced by 50 new ones with digital program control. Electronics has made it possible for every worker to broaden his own service zone. Therefore, the technology has been out to use over two to three shifts and the output increased with no increase in the number of workers.

A. Korabel'nikov, the deputy chief engineer of the Leningrad plant said that his firm hopes to attain a more effective technology with a basic machine operated by a digital program control. However, the stoppage involves no small expense because the introduction of the new equipment is only half of the problem. It is necessary to provide during operation the greatest work load for electronically controlled equipment. The CPSU Central Committee's decree, "On the Work By the Leningrad District CPSU to Greater Intensify Economy in the 12th Five-Year Period by Accelerating Scientific and Technological Progress," emphasized the importance of making better use of our existing production and scientific-technological potential.

The Leningrad Optical Equipment Combine has compiled a comprehensive plan for more extensive use of digitally-programmed machine tools. In the central technical training school, personnel is being trained to operate several machine tools and specialists are being prepared to service the new technology. Production-line workers are being organized into crews. The personnel of the plant is interested in fulfilling the task with the least manpower. Activities to streamline operations and cut costs are also being conducted.

The collective at the Leningrad plant decided this year to bring the shiftwork coefficient of digitally-programmed machine tools up to 1.86. This is being successfully realized and the proof of this is the overs fulfillment of the task to increase labor productivity by more than 1 percent.

## METAL-CUTTING AND METAL-FORMING MACHINE TOOLS

### BRIEFS

PRECISION GEAR CUTTING MILL--The Ministry of Machine Tools and Instrument Industry [Minstankoprom] recommended to the USSR State Pricing Committee [Goskomtsen SSSR] a limit price of 39,500 rubles for the 53A11 semiautomatic vertical general-purpose gear cutting mill manufactured by the Yegorevsk Komsomolets Plant near Moscow. The device is designed to cut cylindrical gears and is highly accurate. In comparison with standard cutting mills, it has greater output and more technological capabilities. The smallest gear-tooth span has been increased and the mill's period of precision performance without overhaul has been extended mill 15 percent (7.5 years instead of 6.5 years). Having determined the manufacturing costs and profits brought in by the new mill, the USSR State Pricing Committee placed a limit price of 32,500 rubles on the 53A11 semiautomatic general-purpose vertical gear-cutting mill. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 35, Aug 84 p 8] 12261

CSO: 1823/17

## OTHER METALWORKING EQUIPMENT

### DEVELOPMENTS IN LASER CUTTING TECHNOLOGY VIEWED

Leningrad LENINGRADSKAYA PRAVDA in Russian 19 Aug 84 p 2

[Article by M. Fadeyeva: "All-Purpose Laser"]

[Text] Lasers have become widely used in our national economy. In recent times, scientists have devoted an increasing amount of attention to the development of laser technology. The simplest example of this is a wishing machine's tank. When this tank is being welded together, the seams must be cleaned. Experiments conducted by researchers at the All-Union Institute of Electric Welding Equipment [VNIIESO] have shown that laser welding requires no further treatment of the weld seams and this subsequently reduces costs in time and manpower.

According to S.K. Kartavyy, director of the special welding methods division of VNIIESO: "A laser solves several problems at once. It can be used for welding, cutting, heat treatment and surface work."

Since 1977, the laser equipment and laser technology laboratories of this division have been involved in the development of all-purpose lasers for welding, metal-cutting and heat treatment. In these 7 years, the specialists of these laboratories have cooperated with different scientific research institutes and factories to create 14 experimental lasers.

The first time that the great possibilities of laser technology were shown was at the 1982 International Elektro-82 Exhibition in Moscow in which laser equipment manufactured by the Leningrad and Novosibirsk institutes of theoretical applied mechanics was successfully demonstrated.

At the present time, both laboratories under the leadership of L.A. Shternin and V.S. Smirnov are working on the development of two types of lasers: an all-purpose pulse batch-action laser and a continuous wave laser. Some of these experimental models will be sent to different scientific research institutes for further testing while the remainder will be given to factories at which specialists will use them to create laser-based production lines.

The advantages of laser technology are unquestionable. Lasers have no rivals in cutting thin 1-5 mm plates and metal surface-welding. Whenever



the power of laser equipment is increased, it attains even more production capabilities. Thus, a 5-kW continuous wave laser can very efficiently weld, cut and heat treat materials of up to 8 mm thickness.

In 1983, the laboratories named above were ordered to create laser equipment for Rostsel'mash [Rostov Agricultural Machinery Plant]. The specialists at these laboratories had already worked out a technology for cutting 1.4 mm steel tubes that will be later used to manufacture parts for the new Don combine.

The versatility of lasers has created a wide range of prospects for their use in flexible manufacturing systems as well as other complexes and systems based on the newest scientific and technological advances.

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## OTHER METALWORKING EQUIPMENT

### STAMPING TECHNOLOGY FOR BEARING RACE PRODUCTION

Moscow MOSKOVSKAYA PRAVDA in Russian 6 Jul 84 p 1

[Article by S. Nikolayev: "Cold Plus Pressure"]

[Text] A new technological development has been given industry by specialists at the Moscow Institute of Machine Tools.

In terms of precision, the manufacture of rings and rollers for modern bearings is comparable to watchmaking. Actually, at the present time, no greater tolerances than fractions of a millimeter are allowed in this technology. Of course, there are still other difficulties that the manufacturers of ball bearings must face. One of these difficulties, for example, is that the consumers need bearings made from hard grades of steel that are difficult to machine.

Dealing with this and many other technical problems increases the work that must be done by specialists at Stankin's [Moscow Institute of Machine Tools] department of tools and forging and stamping technology.

They have presented a method for cold extrusion of precision blanks for bearing rings and rollers. At the same time, we would like to point out that the technological processes developed by the specialists may also be used in the manufacture of many other machine parts.

One of the main advantages of the new technology is its low amount of waste. As tests of the process have shown, cold extrusion of precision blanks can sharply reduce machining allowances and therefore save between 20 and 30 percent of the metal used.

The economic effectiveness of the process developed by the Stankin specialists also comes from the fact that its introduction sharply lowers the labor-intensiveness of production. As we know, the accuracy and quality of blank surfaces produced using the new technology are so high and that rings and rollers will now need a much lower amount of working on lathes. This will, on one hand, accelerate the production process and increase the production output and, on the other hand, free workers and lathe equipment for other tasks.

Still another important point is that for the cold extrusion of many standard size rings, it is possible to use the metal remaining from semi high-temperature stamping processes which is at the present time widely used in bearing shops. This alone promises a yearly savings of 1000 tons of expensive metal pipe for each standard ring size.

The specialists that developed the new technology took care that this process would not make it necessary to design and build a new set of process equipment. This progressive technology can be realized using existing multiposition automatic presses and modern automated process lines.

The Stankin specialists developed this patented process in close cooperation with bearings manufacturers. Already by the end of the present 5-year period, there are plans to introduce these progressive technological processes in the bearing production shops at GPZ-1 [State Bearing Plant] and many other such plants. The economic effect expected from the introduction of the new technology should be as much as half a million rubles per year. Other such fruitful contacts have been set up by Stankin with many other enterprises in Moscow. This should make it possible for the institute to sharply increase the practicality and applications of its research in the present 5-year planning period.

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CSO: 1823/18

DURABILITY OF CUTTING TOOLS IMPROVED

Moscow VECHERNAYA MOSKVA in Russian 14 Jul 84 p 2

[Article by V. Zhed', doctor of technical sciences, professor and director of the All-Union Science and Research Institute for Tools: "Tools Hardened by Plasma"]

[Text] An initiative by the leading industrial enterprises of Moscow to convert their basic equipment to two-shift operation has been approved by the bureau of the Moscow Municipal CPSU Committee and widely supported in many collectives. V. Zhed', doctor of technological science, professor and director of the All-Union Institute of Scientific Research Instruments describes the contribution made by scientists to increase the effectiveness of the use of machine-tooling stock.

A distinctive feature of recent times are the quick changes that have occurred in the conditions and nature of production. Factories and plants are being equipped on an ever greater scale with digitally-programmed machines and robotic systems.

All of this progress makes new demands on production in the machine tooling and metalworking industry. A tool should be reliable and precise. The development of innovations to meet these new demands is one of the directions our work is taking.

A large amount of research is also being conducted on the creation of precast tools. In tools of this sort, only the cutting parts of tools are made from special materials and this lowers the cost of these tools by reducing the amount of expensive and scarce metals used to manufacture them.

Much work is also being done to perfect the technological processes used in tool manufacturing. For example, the Bulat set-up has become widely-used in our industry's plants. These are used to apply abrasion-proof coverings to tools made from high-speed steel. Thanks to this operation, the service life of cutting mills and tools is doubled or tripled in comparison to that of standard instruments.

It is very important that the new technology be used rationally and efficiently. One of the main ways of most effectively using it is to divide the work operations into two shifts.

One of the initiators of this important work is the Moscow Tool Works which has maintained ties of close creative cooperation with the All-Union Institute of Scientific Research Instruments. New designs and products are first tested and introduced at the Moscow Tool Works.

Obsolete equipment is continually being replaced at the works. Its shops are being equipped with robots and digitally-programmed automatic machines. There are already about 50 such devices in use at the Moscow Tool Works.

We still must help the production collective in preparing the technology and the training of its personnel to work with complicated machinery. Workers of various specializations and technologies have raised their qualifications in courses organized at the institute. Representatives of the Frezer plant and the production line of the Sergo Ordzhonikidze Machine-Building Plant have also studied in special courses at the institute.

This has helped make it possible to start-up in the second shift an installation for vacuum-plasma application of abrasion-proof coverings to cutting tools. Two shifts are also now using a set of semiautomatic lathes equipped with robot-manipulators. This device works three times faster than traditional revolver lathes.

The shiftwork coefficient of the most important part of the machine stock at the Moscow Tool Works has reached a value of two.

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CSO: 1823/18



## OTHER METALWORKING EQUIPMENT

### BRIEFS

GIANT REFRACTORY PRESSES ASSEMBLED--DNEPROPETROVSK--A considerable increase in the output of refractory items for metallic equipment has been made possible by the use of heavy-duty presses the manufacture of which has been mastered by Dnepropetrovsk Heavy-Duty Press Manufacturing Combine. Laborers at the works have completed assembly of the first two such giants. The new presses are able to produce forces of up to 1000 tons. Working automatically according to a waste-free technology, they not only speed up the manufacturing process but also yield high-quality products. The first of these presses will soon go into operation at the Chasovoyarsk Refractory Materials Combine in the Donbass region. By the end of this year, the Dnepropetrovsk Heavy-Duty Press Manufacturing Combine will produce still another four presses of the new design. [Text] [Baku VYSHKA in Russian 4 Sep 84 p 1] 12261

CS0: 1823/18

## DESIGN FEATURES, APPLICATIONS OF NEW ROBOTS

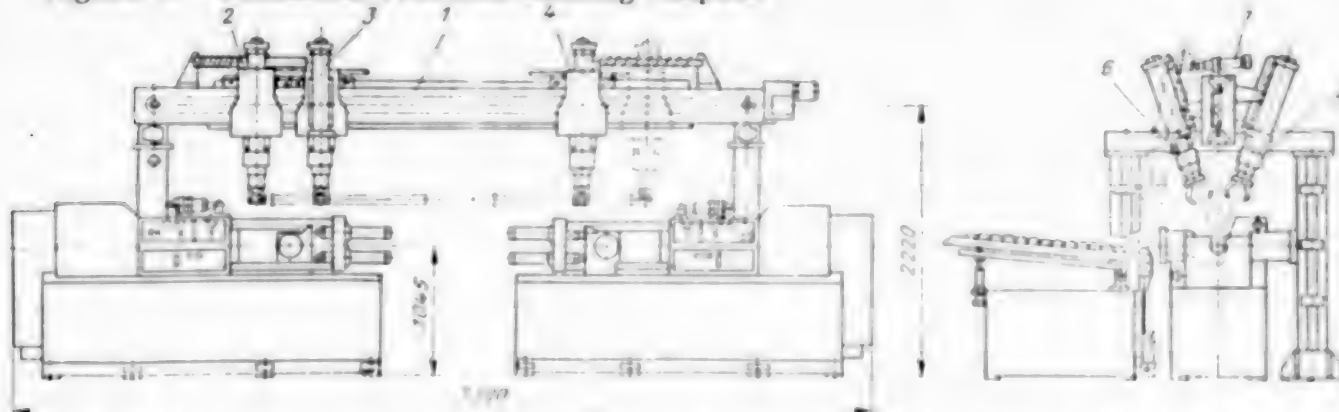
Moscow MEKHANIZATSIYA I AVTOMATIZATSIYA PROIZVODSTVA in Russian No 5, May 84  
pp 41-46

[Article by engineer V. I. Khar'kov under the heading "Automation Equipment at the USSR Exhibit of Economic Achievements": "Automatic Manipulators (Interbranch Display at the USSR Exhibit of Economic Achievements)"]

[Text] The "Automatic Manipulators" display at the "Machinebuilding" pavilion of the USSR Exhibit of Economic Achievements has been updated for the third time. This article describes the new displays in this exhibit.

Automated complex for friction-welding three piston parts (shaft, ear, stem). The complex (Figure 1) consists of two adjacent machines 180° to each other.

Figure 1. Automated Friction-Welding Complex



Each machine contains a bed containing a headstock and rotation mechanism, a collet chuck and clamps for gripping the nonrotating portion of the item being welded. A gantry (1) is mounted along the axis of the machine; on it are installed loading robots (2), travel robots (3) and unloading robots (4). Robot (3) is chain driven and is equipped with a capture tip (5). The capture tips (6) of robots (2) and (4) can be rotated by pneumatic cylinder (7). Shelving for loading and unloading parts is mounted on the side opposite the operator's work station.

When the complex is operated, the piston rod (8) is fed by robot (2) from the shelving to the clamps. At the same time, a piston stem (9) is fed to the

chuck. Both parts are clamped and the rotation mechanism is switched on. When a certain number of revolutions is reached, the mechanism developing axial pressure is activated, moving the clamps and piston stem (9) until it abuts the end of the stem.

After the welding process is complete, the clamps return to the initial position and instruct the capture tip of robot (3) to engage the welded item, lift it and begin moving it to the other machine. While this is being done, the piston ear (10) is being fed to the chuck of this machine and robot (3) catches the stops on the housing of robot (4), moves it to the right and lets the item down into the clamps. Robot (2) simultaneously loads the piston stem into the clamps of the first machine.

After the items are clamped in both machines, robot (3) begins moving left. The drives of both machines are switched on at that instant and the welding process proceeds simultaneously. When the welding is complete on both machines, robots (3) and (4) take an item; the first moves one to the other machine and the second moves one to the unloading shelving. The cycle is repeated.

#### Specifications:

productivity, welds/hr	60
carriage travel speed, m/min	
cruising	3.15
tuning	3.85
maximum item diameter, mm	100
item weight, kg	up to 60
dimensions, mm	7,300 x 3,300 x 2,800
machine weight, kg	18,000

Introduction of the complex frees nine workers and 10 pieces of equipment for other work and saves metal and electricity. The annual economic impact is 86,500 rubles.

The complex was introduced at the Galichskiy Excavator Plant.

Developed by VPTIstroydormash; manufactured by VPTIstroydormash pilot plant.

Installation for automatic and semiautomatic bearing race seam welding (Figure 2, following page). Can be used to weld various items requiring rotation and tilting while being processed.

The installation is in the form of a vertical column with a base on which all subassemblies and mechanisms are mounted. A table on which the manipulator is installed and secured is moved up and down the column manually. The manipulator faceplate can be set in any position convenient for welding; it is equipped with lugs for securing the item. The manipulator is remote controlled by foot pedal or from a control panel. The working rotation speed is set by nomogram as a function of faceplate rotation speed to seam diameter and welding speed.

The electric drive speed is continuously variable, regulating the number of rotations of the faceplate and item fixed to it.

Figure 2. Race Seam Welder

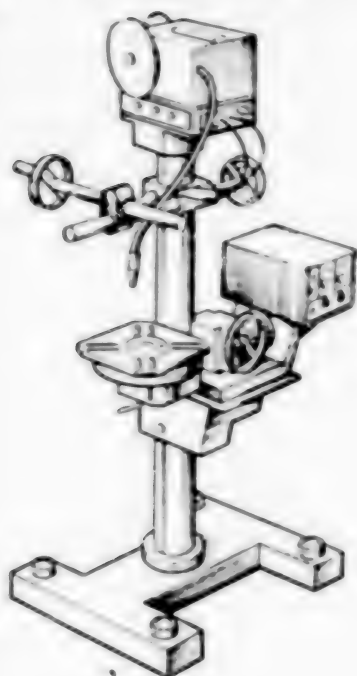
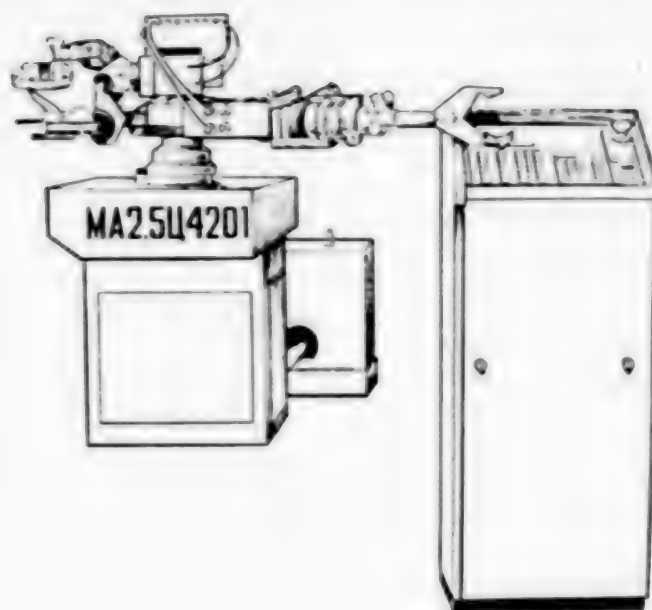


Figure 3. Unitized Industrial Robot



Two rods along which the clamps move are attached perpendicular to one another in a rotating holder in the upper part of the column. The transverse rod is secured in the horizontal rod clamp; on it is an arm on which the hose of the semiautomatic welder is installed. Each rod can be turned about its own axis, and both rods together can be turned about the column axis. The rods are clamped and the rods are held in position by a special brake.

A special hollow-body spindle manipulator with a through aperture can be installed on the table instead of the model M11010 manipulator. Several installation variants are possible.

Specifications:

load capacity, kg	50
greatest diameter of part being welded, mm	360
spindle rotation speed for welding, rpm	0.125 - 6.3; 0.1 - 5.0; 0.2 - 11 0.3 - 15
table travel (vertical), mm	560
rod holder travel, mm:	
longitudinal	400
transverse	224

The annual economic impact of introducing one such installation is 2,000 rubles.

Developer: Mechanical Welding Equipment Scientific-Production Association.

The unitized industrial robot (Figure 3, above) is used for automated technological complexes to feed single blanks to a press stamp and to remove the stamped parts.

The robot is of unitized-modular design, consisting of nine standardized sub-assembly units. The robot grasps a blank in the reference position, it raises, tilts (if necessary) and feeds the blank to the stamp, sets the blank in the stamp, grasps the stamped part and removes it from the stamp, and drops the part into a package.

Use of the robot eliminates human participation when on automatic; the robot is controlled from a panel in an enclosure.

Series production of the robots began in 1983. The annual economic impact of introducing one robot is 30,000 rubles.

#### Specifications:

load capacity, kg	2.5
number of	
degrees of mobility	4
arms	2
positioning accuracy, mm	±0.1
greatest arm travel, mm:	
horizontal	630
vertical	125
arm rotation in the horizontal plane, degrees	90
average speed of arm travel:	
horizontal, m/sec	1.2
vertical, m/sec	0.5
angular, degrees/sec	120
gripper rotation, degrees	180
speed of gripper rotation, degrees/sec	180
execution drives	pneumatic
control system	cyclical
productivity at maximum travel, parts/min	12
proposed dimensions, mm	1,400 x 1,000
weight, kg	409

Developer: PKTikuzrobot; manufacturer: Khmelnitkiy Automatic Thermoplastics Production Association.

The AP-400 automatic manipulator is designed to move parts, following a prescribed program, by suspension arm or loaded into the drums of automatic and automated lines for electroplating rectangular configurations.

It is used in electroplating shops and sectors or divisions for preparing surfaces at machinebuilding and instrument-making plants.

The main parts of the AP-400 are the bed, undercarriage, travel drive, lift drive, carriages, load grasp, load sensors, lift and drop limit sensors, travel speed sensors, positioning sensors, collision prevention devices, electrical equipment, and control adjustment apparatus.

The automatic manipulator operates automatically or automated. Manipulator programming and adjustment are done by the electroplating line operator.



#### Specifications:

load capacity, kg	400
carriage travel speed, m/min:	
horizontally	22/7.33
vertically	8.5
vertical carriage travel, maximum, mm	1,620
positioning accuracy, mm	±12
installed power, kW	2
dimensions, mm	1,175 x 1,794 x 2,610
weight, kg	590

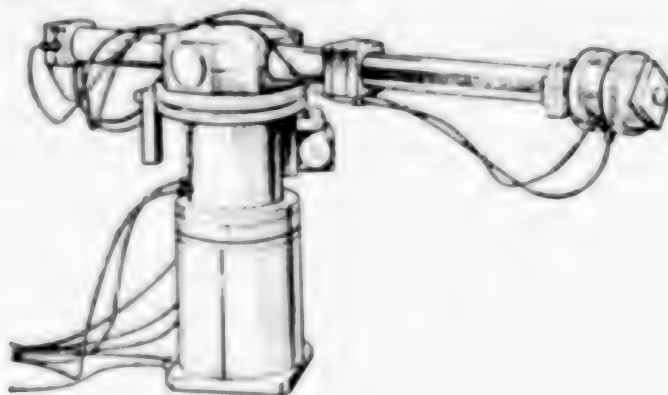
Introduced at the Cherkassy Machinebuilding Plant imeni G. I. Petrovskiy.

The annual economic impact of introducing this electroplating line with automatic manipulator is 12,500 rubles.

Developer: Cherkassy Planning-Design Technological Institute; manufacturer: Cherkassy PKTI [as above] pilot plant.

An automatic programmed-control (PC) manipulator (Figure 4) designed for use in machining, assembly, forge-press, billet and other production; permits the comprehensive mechanization and automation of auxiliary operations as part of robotized technological complexes. The automatic manipulator can be operated only in closed, heated premises.

Figure 4. Automatic SPU Manipulator



The modular-design manipulator consists of a number of functional elements (modules), pneumatic equipment and controls. The presence or absence of any particular module in the manipulator is determined by the corresponding technological process.

The manipulator arm is telescoping, with a built-in hydraulic damper. The rotary module for turning the part about the arm axis is secured to a flange on the movable portion of the arm. The module vane is installed on a shaft with a flange to which a gripper is secured. The arm is installed on the platform of the rotation module, which turns the arm about the vertical axis. The rotation module has a hydraulic shock absorber to slow the speed at the end of the turn.

The module design is vane-type, as is that of the rotation module. The turn module is installed on the housing flange of the arm lift module, a pneumatic cylinder.

The manipulator pneumatic equipment consists of an air preparation unit and a pneumatic distributors unit and electromagnets. The pneumatic distributors feed compressed air to the proper chamber of the appropriate module on signal from the control unit.

The control unit consists of a command KEP-12U electropneumatic device and manual control panels. The unit regulates the duration and sequence of the various technological processes following a prescribed control program; the purpose of the control panel is for selecting the operating routine (automatic or adjustment), for guiding the manipulator in the appropriate routine and monitoring its work, for which purpose the panel is provided with switches, buttons and indicator lights.

#### Specifications:

load capacity, kg	3
vertical lift, mm	50
drive system	pneumatic
control system	electrical
power consumption, watts	260
dimensions (excluding control unit and pneumatic equipment) with arm drawn in and lift module at lowest position, mm	840 x 230 x 470
weight, kg	83

The economic impact of introducing the robotized technological complex is 10,000 rubles.

The automatic manipulator has been in series production since 1982. It was introduced at the Ventspils Ventilator Plant imeni Jan Fabritsius. Developer: VPKTIstroydormash NPO.

Angular-type MRU manipulators are designed for loading-unloading, transport and assembly operations. They can be used for loading (unloading) technological equipment (assembly, press and other equipment) as a part of orienting units, as well as for parts grouping and composition operations.

A communications unit in the MRU-901A permits coordinating control of the equipment and the manipulator, as well as of the execution mechanisms for feeding blanks to the grasp zone, monitoring the presence of blanks and removing parts from the working zone.

Specifications:	MRU-901	MRU-901A	MRU-902
load capacity, kg	0.08	0.08	0.35
arm rotation angle, degrees	20-90	20-90	30-90
vertical travel of arm, mm	1-10	1-10	5-30
arm extension from axis of rotation (maximum), mm	150	150	300

[continued on following page]

Specifications (continued)

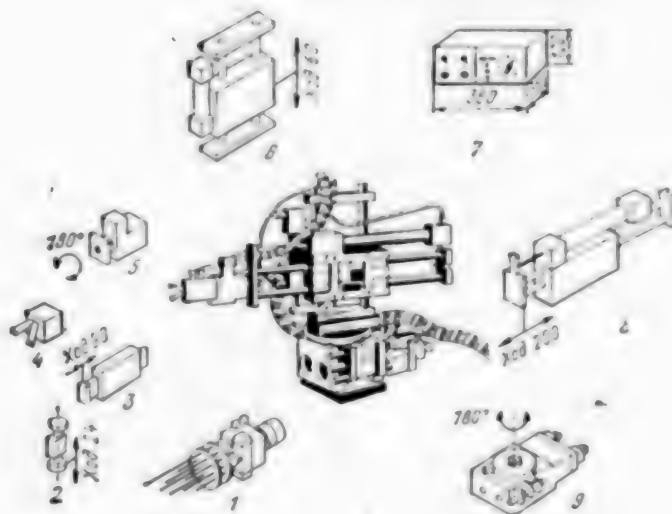
	MRU-901	MRU-901A	MRU-902
positioning accuracy, mm	$\pm 0.02$	$\pm 0.02$	$\pm 0.02$
cycle, seconds	2	2	2
operating routine	automatic and adjustment		
drive	electromechanical		electromechanical, reversible
feed from a.c. circuit			
number of technological commands	4	4	8
method of temporarily issuing technological commands	cam command	--	cam command
number of information channels		5	
purpose of information channels		[*]	
weight, kg:			
manipulator	14.5	14.5	38
communications unit	--	10	--

[\*] monitor presence of parts in working position of grasp, monitor operation of technological equipment, and so forth

The annual economic impact of introduction: 8,000 rubles.

Modular robots of the MRL type are designed for loading-unloading, transport and basic technological operations such as loading (press equipment, rotating tables of unit machine tools and assembly machines), assembly, welding, monitoring, and so on.

Figure 5. MRL Robot Modules



[Key to Figure 5 on following page.]

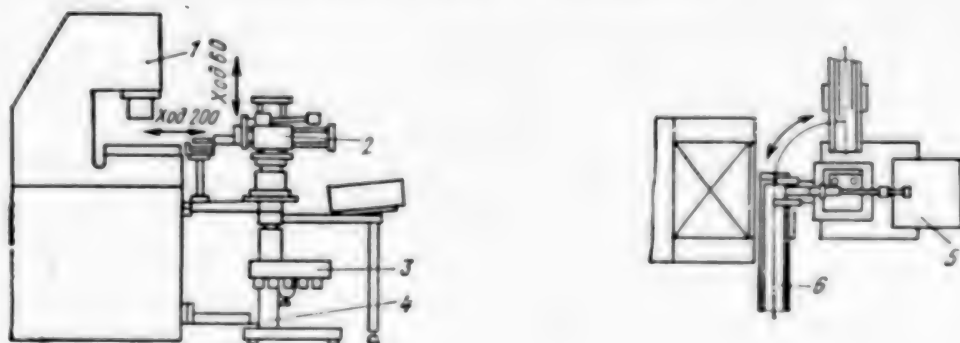
- [Key]
1. Intermediate positioning mechanism
  2. Horizontal head (travel 24; (3) -- travel 90)
  4. Gripper
  5. Gripper rotation module
  6. Vertical module (travel 60)
  7. ESU-901 control system
  8. Horizontal module (travel 200)
  9. Turn module

The robots are modular in design (Figure 5, preceding page), enabling one to choose the most economical of all possible arrangements depending on the nature of the operations being performed (see Table, following page).

The following are being manufactured to feed positioned parts to the manipulator gripper: single-coordinate cassette feed mechanisms (two types); two-coordinate cassette feed mechanisms (two types); flat blank PZV-901 vertical feed unit; flat blank PZSh-901 gate feed unit; a single-belt conveyor.

A robotized technological complex can be arranged using various types of auxiliary equipment and modules. One example of an RTK [robotized technological complex] arrangement would be the "cap" type tension drawing line shown in Figure 6.

Figure 6. Robotized Technological Complex Arrangement



Key:

1. Press
  2. MRLU-200-901 robot
  3. Automatic pneumatics elements
  4. Multipurpose pedestal
  5. ESU-901 control system
  6. Conveyor (feed)
- (horizontal travel -- 200; vertical travel -- 60)

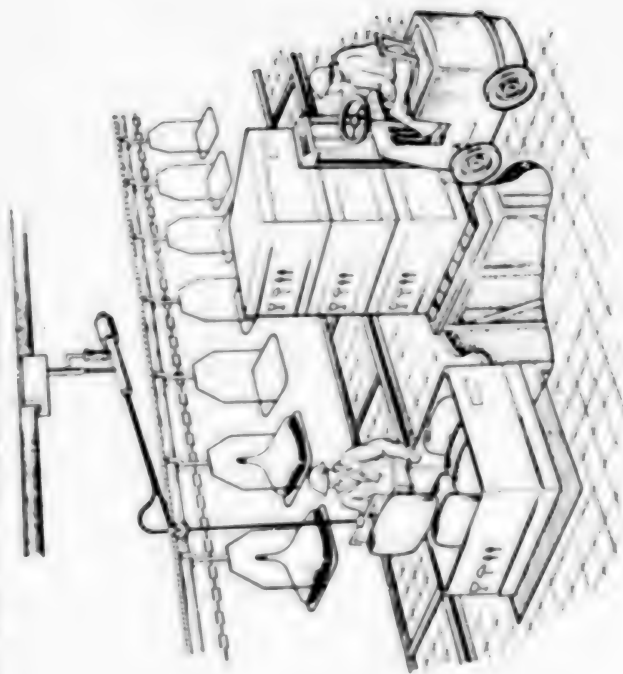
The transport manipulator shown in Figure 7 (page following) is designed to mechanize loading and unloading, including end-line operations in TV picture tube production.

The manipulator operates using a system of levered weights in the form of a balanced system.

Specifications:

load capacity, kg	MRL-90-901	MRL-90-901	MRL-200-901	MRL-200-901A	MRL-200-901
linear travel, mm:	0.2	0.2	0.5	0.5	0.5
horizontal	90	90	200	200	200
vertical	8-24	8-24	60	60	60
number of intermediate points in horizontal travel (provided by movable stops)	--	10	--	10	--
travel speed, m/sec:	--	--	--	--	--
horizontal	--	--	0.5 - 0.8	0.1 - 0.3	0.5 - 0.8
vertical	--	--	0.1 - 0.3	0.1 - 0.3	0.1 - 0.3
positioning accuracy	--	--	±0.02	±0.02	±0.02
control system	±0.01	±0.01	ESU-901	ESU-901	ESU-901
weight, kg	ESU-901	ESU-901	13.5	14.5	26
weight (with control system), kg	--	--	--	--	--
dimensions	16	17.5	--	--	--
	252x70x125	252x150x125	516x136x255	516x204x255	595x322x378

Figure 7. Transport Manipulator for TV Picture Tubes





The system is balanced in any given position by a counterweight and pneumatic cylinder; the calibrated force at the manipulator operator's hand when the unit is loaded is less than 3 kgs. The manipulator is push-button and crank controlled.

The picture tube is taken off the overhead conveyor by a swivel gripper at the lugs. The picture tubes are placed in the crating in a horizontal position.

#### Specifications:

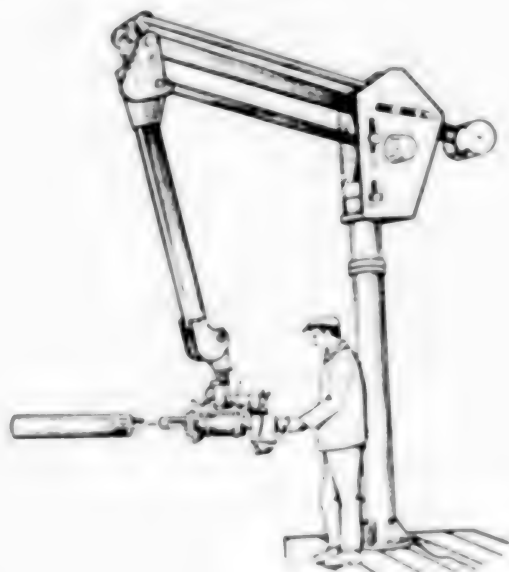
load capacity, kg	25
area of working zone, m <sup>3</sup>	65
carriage drive	electromechanical
manipulator drive	pneumatic
carriage travel speed, m/sec	0.2
lever mechanism turn angle about the vertical axis, degrees	360
manipulator dimensions, mm	1600x500x3200
weight, kg	110
power consumed, kW	0.2
compressed air consumption, m <sup>3</sup> /hr	2

The annual economic impact of introduction: 5,000 rubles.

Developer and manufacturer: TsNII "Elektronika".

The manipulator shown in Figure 8 is designed to mechanize manual labor in free forging and stamping. It enables us to eliminate shock and vibration transmitted to the hands of the forge operator and ensures reliable mechanical grasping of the blank, guaranteeing safe manipulation of the blank during the work.

Figure 8. Manipulator for Forging



The manipulator grasps the heated blank, moves it to the hammer (press) and manipulates it during the forging (stamping) process. Vertical travel is achieved using a mechanical drive, but all other movements are manual, using a slight amount of force (horizontal in the plane of the boom, gripper rotation relative to the suspension unit and about its own horizontal axis, and so on).

The manipulator gripper is equipped with replaceable jaws which securely clamp a blank of any configuration; it also has a device which protects the worker from vibration and shock during operation.

#### Specifications:

load capacity, kg	100
load torque, kH·m	0.75
clamping force, kH	8.40
number of degrees of mobility	6
turn radius, mm:	
maximum	3,000
minimum	500
lift height, mm:	
maximum	1,250
minimum	250
power, kW	0.85
force at control arms, H, maximum	100

Use of the manipulator makes the labor of forge (press) operators significantly easier, improved safety and labor productivity, and also raises production standards.

The economic impact is 10,000 rubles per year.

Developer: "VITstroydormash" NPO; manufacturer: TZTO production association.

The balancer-manipulator shown in Figure 9 [following page] is designed for technological and loading-unloading operations in production shops and warehouses.

The balancer-manipulator design allows rapid replacement of the load-gripping devices. By using special grippers, the load can be oriented spatially in any position, which cannot be done with an ordinary load-lifting crane.

The load is lifted and the boom extension changed mechanically; turning around the columns is manual, with the application of a small amount of force.

#### Balancer-Manipulator Specifications:

load capacity, kg	320
load torque at gripper, kH·m, maximum	0.96
grapple lift height, mm	2,600
boom extension, mm:	
minimum	500
maximum	3,000

[continued]

Specifications [continued]:

load lift speed, m/min:	
first	6
second	12
boom extension change speed, m/min:	
first	4
second	12
weight, kg	1,100

Figure 9. Balancer-Manipulator

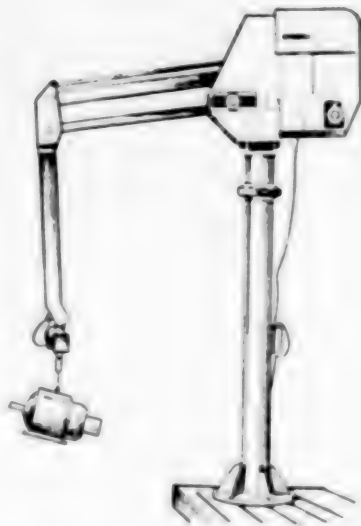
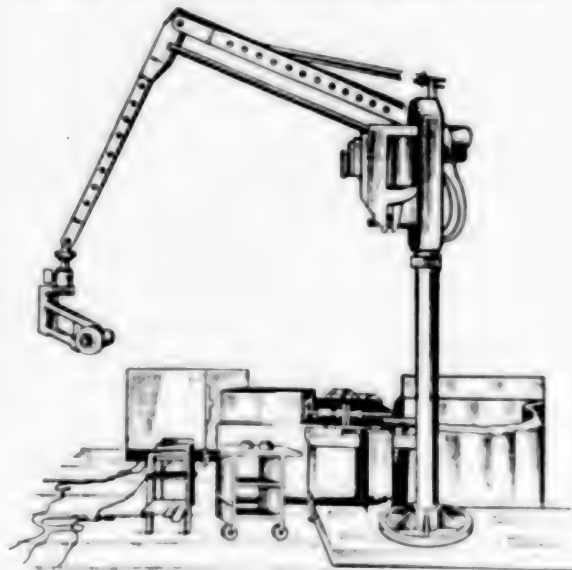


Figure 10. Manipulator With Level



Developer and manufacturer: "VITstroydormash" NPO

The manipulator with leveling device, shown in Figure 10, is designed for loading-unloading, transport and technological operations in shops and warehouses.

The manipulator consists of a column, boom head and control panel, and gripper. The manipulator operates with a balanced load, which is ensured by a spring device preset for the load from the control panel.

Specifications:

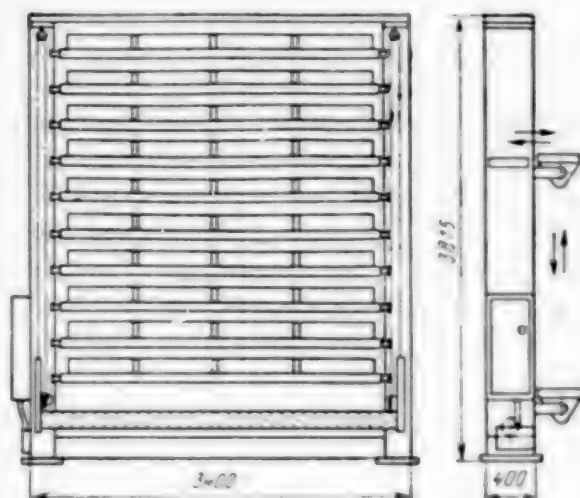
load capacity, kg	100
radius, mm:	
minimum	500
maximum	3,000
lift height, mm	2,150
load movement force, H, maximum	60
manipulator height, mm	4,545
weight, kg	565

Annual economic impact of using one manipulator is at least 1,000 rubles.

Developer and manufacturer: "Vitstroydormash" NPO.

The TKhP 78 automated shelf manipulator (Figure 11) is a shelf system for accumulating loads (including long items) for storage, with automatic shelf feed to a fixed lower position (  $750 \pm 5$  mm from floor level) for subsequent unloading using shop lift equipment, including automatic grippers or other automatic take-up devices.

Figure 11.



The shelves are set at the height of the manipulator housing stands using electrically powered clamps and a special cable suspension.

After the loaded shelves are fed out, they are automatically reset to their previous position. The shelves can be equipped with devices for holding loads in a set position for operation in conjunction with a robot.

As shelves are loaded and unloaded in the lower fixed position, they have free access across the entire upper surface, which is accessible to any lift devices.

The manipulator can be used as a component of an automated system for accumulating and feeding technological lines handling blanks, as well as as independent shelving for accumulating parts and blanks to service work stations in machining shops and sectors.

Use of the manipulator enables one to free production space for other use thanks to its compactness and high load capacity, as well as to solve the problem of comprehensively mechanizing and automating difficult physical labor involved in loading and unloading operations.

Specifications:

load capacity, tons	6
number of shelves	10
[continued]	

Specifications [continued]

dimensions, mm:	
shelves	3300 x 350 x 155
manipulator	3400 x 40 x 3815
vertical travel drive:	
electric motor power, kW	1.5
angular speed, rpm	1,500
horizontal travel drive:	
electric motor power, kW	0.25
angular speed, rpm	750
weight, kg	800

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## ROBOTICS

### NEW APPLICATIONS FOR ROBOT LOADERS, UNLOADERS

Moscow EKONOMICHESKAYA GAZETA in Russian No 33, Aug 84 p 24

[Article by A. Mishin, photographs by V. Tokareva: "New Exhibition of Industrial Robots"]

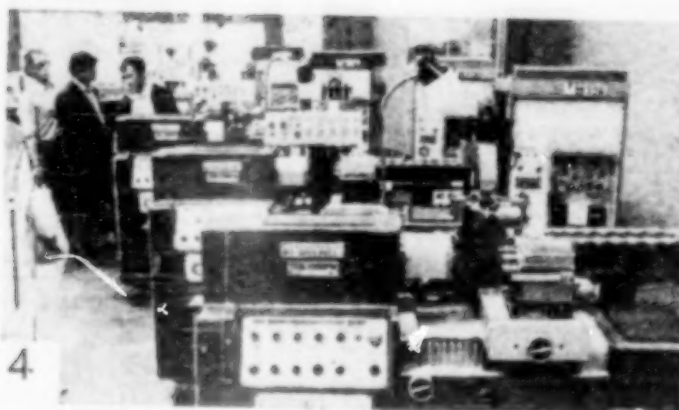
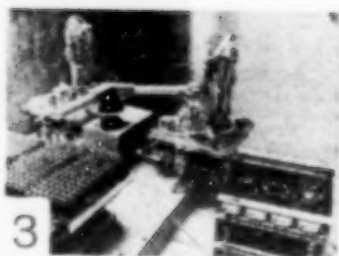
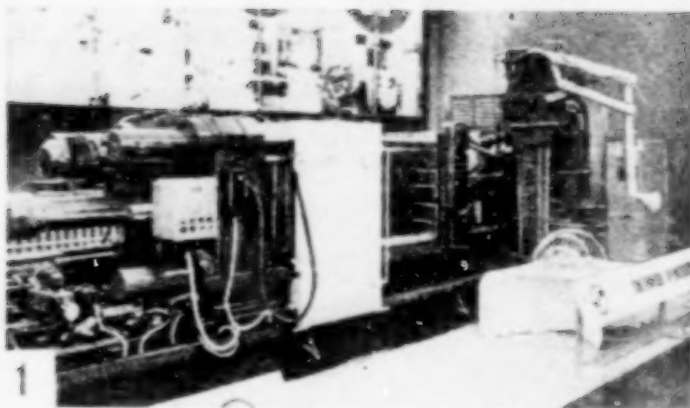
[Text] At the Machine Building Pavilion there is a new display at the permanent exhibit of industrial robots and robotized manufacturing complexes.

An outstanding feature of this show is that it vividly demonstrates practical applications. Each of the more than 100 intelligent machines presented here, lessening human labor and freeing it from heavy and monotonous operations, has already been introduced into production.

One of the most effective examples is an A711B09 automated complex for pressure casting (Illustration 1.) built by the Tiraspol Casting Machinery Plant. Three manipulators (for casting metal, lubricating forms and removing castings) and a device for lubricating the plunger replace heavy manual labor in the manufacture of non-ferrous metal castings. The complex produces four castings per minute. Each such complex has an annual economic effect of 55,500 rubles.

The TKhP78 shelf manipulator (Illustration 2. [Not shown]) is also solving the problem of automating heavy physical labor. It is "entrusted" with loading and unloading work in production and storage facilities. An excellent feature is its compactness with large lifting and storage capacity, the 10 shelves have a total capacity of 2 tons. It was developed by the SKTBkhimmash [Special Planning and Design Office for Chemical Machinery] in Moscow and built by Mashinostroitel', an experienced plant in the capital.

The high fatigue rate for workers in some operations is explained in many cases not only by the laboriousness, but also by the monotony of the operations performed, for example, supervising the contact of modular switches. The two handed industrial robot (Illustration 3.) presented by the Elektronika TsNII [Central Scientific Research Institute] can hourly check more than 400 switches without making errors. In addition, it can mark and pack items.



Some unique machine tools can be distinguished among the individual models. These are components of flexible production. The creation of large, robotized lines is most advantageous. The Volna TsNTI [Center for Scientific and Technical Information] technical unit for multi-machine tool servicing (Illustration 4.) is based on five RTK [robot technological complex] modules and a RP-901 industrial robot is an example of this. Up to 24 machine tools on a line can be controlled by a single computer.

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